Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS): Tallil Air Base (AB) and Vicinity, Iraq: 2003 to 2011

AUTHORITY: This periodic occupational and environmental monitoring summary (POEMS) has been developed in accordance with Department of Defense (DoD) Instructions 6490.03, 6055.05, and JCSM (MCM) 0028-07, (References 1-3).

PURPOSE: This POEMS documents the Department of Defense (DoD) assessment of occupational and environmental health (OEH) risks for Tallil Air Base (AB), Ali AB, An Nasariyah, Camp Adder, Camp Mittica, Convoy Support Center (CSC) Cedar II, and Main Supply Road (MSR) Tampa South, Iraq. It presents a qualitative summary of health risks identified at these locations and their potential medical implications. The report is based on information collected from March 2003 through October 2011 to include deployment OEH surveillance sampling and monitoring data (e.g., air, water, and soil), field investigation and health assessment reports, as well as country and area-specific information on endemic diseases.

This assessment assumes that environmental sampling at Tallil AB and vicinity during this period was performed at representative exposure points selected to characterize health risks at the *population–level*. Due to the nature of environmental sampling, the data upon which this report is based may not be fully representative of all the fluctuations in environmental quality or capture unique occurrences. While one might expect health risks pertaining to historic or future conditions at this site to be similar to those described in this report, the health risk assessment is limited to March 2003 through October 2011.

The POEMS can be useful to inform healthcare providers and others of environmental health conditions experienced by individuals deployed to Tallil AB and vicinity during the period of this assessment. However, it does not represent an individual exposure profile. Individual exposures depend on many variables such as; how long, how often, where and what someone is doing while working and/or spending time outside. Individual outdoor activities and associated routes of exposure are extremely variable and cannot be identified from or during environmental sampling. Individuals who sought medical treatment related to OEH exposures while deployed should have exposure/treatment noted in their medical records on a Standard Form (SF) 600 (Chronological Record of Medical Care).

SITE DESCRIPTION: Tallil AB is located near Nasiriyah, Iraq and was an Iraqi airbase during the Iran-Iraq war, when it was called Imam Ali Air Base. Tallil AB is located in southern Iraq, 180 miles southeast of Baghdad. The airfield occupies 30 square kilometers and contains two main runways; however, the Iraqis did not fly aircraft out of Tallil AB between 1991 and 2003. Construction on the site dates from the 1970s. Coalition forces first occupied Tallil AB in March 2003. It was originally commandeered so the coalition could provide theater airlift and combat search and rescue support from a forward location. There are no industrial activities within sight of the base and the adjacent areas are used for dry land wheat, barley, and livestock farming. This POEMS also addresses Camp Adder, An Nasariyah, CSC Cedar II, Camp Mittica, and MSR Tampa South because they are located in proximity to Tallil AB. As of March 2003, Camp Adder was the southernmost Army resupply point in Iraq. CSC Cedar II was the largest CSC in southern Iraq. Camp Mittica is an Italian operated coalition base located in An Nasariyah. MSR Tampa South is the main supply road that runs the length of Iraq.

SUMMARY: Conditions that may pose a moderate or greater health risk are summarized in Table 1. Table 2 provides population based risk estimates for identified OEH conditions at Tallil AB and vicinity. As indicated in the detailed sections that follow Table 2, controls established to reduce health risk were factored into this assessment. In some cases, e.g., ambient air, specific controls are noted, but not routinely available/feasible.

POEMS
Table 1: Summary of Occupational and Environmental Conditions with MODERATE or Greater Health Risk

Short-term health risks & medical implications:

The following hazards may be associated with potential acute health effects in some personnel during deployment at Tallil AB and vicinity, Iraq:

Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}); inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$); food/waterborne diseases (e.g., bacterial diarrhea, Hepatitis A, Typhoid fever, Brucellosis, diarrhea-cholera, diarrhea-protozoal); other endemic diseases (cutaneous leishmaniasis, Crimean-Congo hemorrhagic fever, Sandfly fever, Tuberculosis (TB), Leptospirosis, Schistosomiasis, Rabies, Q fever); venomous animals and insects; heat stress; and noise. For food/waterborne diseases (e.g., bacterial diarrhea, Hepatitis A, Typhoid fever, Brucellosis, diarrhea-cholera, diarrhea-protozoal), if ingesting food and water off post, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (Hepatitis A, Typhoid fever, and Brucellosis). Risks from food/waterborne diseases may have been reduced with preventive medicine controls and mitigation, such as Hepatitis A and Typhoid fever vaccinations, and only drinking from approved water sources in accordance with standing CENTCOM policy. For other vector-borne endemic diseases (cutaneous leishmaniasis, Crimean-Congo hemorrhagic fever, Sandfly fever), these diseases may constitute a significant risk due to exposure to biting vectors; risk is reduced to low by proper wear of treated uniform, application of repellent to exposed skin, and appropriate chemoprophylaxis. For water-contact diseases (Leptospirosis, Schistosomiasis), activities involving extensive contact with surface water increase risk. For respiratory diseases (Tuberculosis (TB)), personnel in close-quarter conditions with infectious individuals for prolonged periods could have been at risk for person-to-person spread. Animal contact diseases (Rabies, Q fever), pose year-round risk. For venomous animals and insects, if encountered, effects of venom vary with species from mild localized effects (e.g., Euscorpius italicus) to potentially lethal effects (e.g., white-horned viper); risk is reduced with proper and timely treatment. For heat stress, risk can be greater for susceptible persons including those older than 45, of low fitness level, unacclimatized personnel, or individuals with underlying medical conditions. Risks from heat stress may have been reduced with preventive medicine controls, proper work-rest cycles, and mitigation. For continuous and impulse noise, risk is to personnel working near major noise sources; risk is reduced to personnel working near major noise sources by consistently wearing proper hearing protection.

Air quality: For inhalational exposure to high levels of dust and PM_{10} and $PM_{2.5}$, such as during high winds or dust storms, exposures may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel while at this site, and certain subgroups of the deployed forces (e.g., those with pre-existing asthma/respiratory and cardio-pulmonary conditions) are at greatest risk of developing notable health effects. Although the overall risk is low for exposure to burn pits (see section 10.8), exposures may also result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups while at this site. Although most effects from exposure to PM_{10} and $PM_{2.5}$ and to burn pit smoke should have resolved post-deployment, providers should be prepared to consider the relationship between deployment exposures and current complaints. Some individuals may have sought treatment for acute respiratory irritation during their time at Tallil Air Base (AB) Iraq (and associated locations). Personnel who reported with symptoms or required treatment while at this site should have exposure/treatment noted in medical record on a Standard Form (SF) 600 (Chronological Record of Medical Care).

Long-term health risks & medical implications:

The following hazards may be associated with potential chronic health effects in some personnel during deployment at Tallil AB and vicinity, Iraq:

The hazards associated with potential long-term health effects at Tallil Air Base (AB) Iraq and vicinity include inhalable particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$); airborne metals; Leishmaniasis-visceral infection; and noise. Leishmaniasis is transmitted by sand flies. Visceral leishmaniasis (a more latent form of the disease) causes a severe febrile illness, which typically requires hospitalization with convalescence over 7 days. Leishmaniasis parasites may survive for years in infected individuals. Consequently, this infection may go unrecognized until infections become symptomatic years later. For continuous and impulse noise, risk is to personnel working near major noise sources; long-term risk is reduced to personnel working near major noise sources by consistently wearing proper hearing protection.
Air Quality: It is possible that some otherwise healthy personnel who were exposed for a long-term period to particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) could develop certain health conditions (e.g., reduced lung function, cardiopulmonary disease). Personnel with a history of asthma or cardiopulmonary disease could potentially be more likely to develop such chronic health conditions. While the PM exposures are documented and archived, at this time there are no specific recommended, post-deployment medical surveillance evaluations or treatments. Providers should still consider overall individual health status (e.g., any underlying conditions/susceptibilities) and any potential unique individual exposures (such as burn pits, or occupational or specific personal dosimeter data) when assessing individual concerns.

Certain individuals may need to be followed/evaluated for specific occupational exposures/injuries (e.g., annual audiograms as part of the medical surveillance for those enrolled in the Hearing Conservation Program; and personnel covered by Respiratory Protection Program and/or Hazardous Waste/Emergency Responders Medical Surveillance).

Table 2. Population-Based Health Risk Estimates – Tallil AB and vicinity, Iraq [1, 2]

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
AIR			
Particulate matter less than 10 micrometers in diameter (PM_{10})	Short-term: Low to High, Daily levels varied; acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects were possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Low to None, Daily levels vary acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).
	Long-term: No health guidelines		Long-term: No health guidelines
Particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$)	Short-term: Low to High, A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.	Limiting strenuous physical activities when air quality is especially poor; and action such as closing tent flaps, windows, and doors.	Short-term: Low, A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.
	Long-term: Low to Moderate, A small percentage of persons may be at increased risk for developing chronic conditions (particularly those more susceptible to acute effects (e.g., those with asthma/existing respiratory diseases).		Long-term: Data quantity insufficient to characterize risk.
Metals	Short-term: Low, Vanadium		Short-term: Low to none
	Long-term: Low, Aluminum, Cobalt, Vanadium		Long-term: Low to none
Military Unique			
Non-ionizing Radiation	Short-term: Low		Short-term: Low to none
	Long-term: Low		Long-term: Low to none
ENDEMIC DISEASE			
Food borne/Waterborne (e.g., diarrhea-bacteriological)	Short-term: High, (Bacterial diarrhea, Hepatitis A, Typhoid fever) to Moderate (Diarrhea-cholera, Diarrhea-protozoal, Brucellosis) to Low (Hepatitis E). If ingesting local food/water, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (Hepatitis A, Typhoid fever,	Preventive measures include Hepatitis A and Typhoid fever vaccination and consumption of food and water only from approved sources.	Short-term: Low to none

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
	Brucellosis, Hepatitis E).		
	Long-term: Not an identified source of health risk.		Long-term: No data available
Arthropod Vector Borne	Short-term: High (Leishmaniasis-cutaneous), to Moderate (Leishmaniasis- visceral, Crimean-Congo hemorrhagic fever, Sandfly fever) to Low (Sindbis, Rickettsioses, Typhus-murine, West Nile fever).	Preventive measures include proper wear of treated uniform, application of repellent to exposed skin and bed net use.	Short-term: Low
	Long-term: Low (Leishmaniasis-visceral infection)		Long-term: No data available
Water-Contact (e.g., wading, swimming)	Short-term: Moderate for Leptospirosis and Schistosomiasis.	Recreational swimming in surface waters not likely in this area of Iraq during this time period.	Short-term: Low to none Leptospirosis and Schistosomiasis.
	Long-term: No data available		Long-term: No data available
Respiratory	Short-term: Moderate [Tuberculosis (TB)] and Low (Meningococcal meningitis).	Providing adequate work and living space; medical screening, and vaccination.	Short-term: Low to none
	Long-term: No data available		Long-term: No data available
Animal Contact	Short-term: Moderate (Rabies and Q-fever), Low (Anthrax and H5N1 Avian Influenza)	Prohibiting contact with, adoption, or feeding of feral animals in accordance with (IAW) U.S. Central Command (CENTCOM) General Order (GO) 1B. Risks are further reduced in the event of assessed contact by prompt post-exposure rabies prophylaxis IAW The Center for Disease Control's (CDC) Advisory Committee on Immunization Practices guidance.	Short-term: Low to none
	Long-term: Low (Rabies)		Long-term: No data available
VENOMOUS ANIMAL/ INSECTS			
Snakes, scorpions, and spiders	Short-term: Low, if encountered, effects of venom vary with species from mild localized swelling (e.g., *Scorpiops lindbergi*) to potentially lethal effects (e.g., *Gloydius halys*).	Risk reduced by avoiding contact, proper wear of the uniform (especially footwear), and timely treatment.	Short-term: Low, if encountered, effects of venom vary with species from mild localized swelling (e.g., *Scorpiops lindbergi*) to potentially lethal effects (e.g., *Gloydius halys*).
	Long-term: Not an identified source of health risk.		Long-term: No data available
HEAT/COLD STRESS			
Heat	Short-term: Low to Moderate	Work-rest cycles, proper	Short-term: Low

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
	Long-term: Low, However, the health risk may be greater to certain susceptible persons–those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.	hydration and nutrition, and Wet Bulb Globe Temperature (WBGT) monitoring.	Long-term: Low; However, the risk may be greater to certain susceptible persons–those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.
Cold	Short-term: Low	Risks from cold stress reduced with protective measures such as use of the buddy system, limiting exposure during cold weather, proper wear of issued protective clothing, and proper nutrition and hydration.	Short-term: Low risk of cold stress/injury.
	Long-term: Low, Long-term health implications from cold injuries were rare but could occur, especially from more serious injuries such as frostbite.		Long-term: Low; Long-term health implications from cold injuries were rare but could occur, especially from more serious injuries such as frostbite.
NOISE			
Continuous (Flightline, Power Production)	Short-term: High to Low, High risk to individuals working near major noise sources without proper hearing protection.	Risks reduced by the use of hearing protection and noise barriers.	Short-term: Low risk to the majority of personnel and to individuals working near major noise sources who use proper hearing protection.
	Long-term: High to Low, High risk to individuals working near major noise sources without proper hearing protection.		Long-term: Low risk to the majority of personnel and to individuals working near major noise sources who use proper hearing protection.
Unique Incidents/ Concerns			
Burn Pits	Low: Acute (short-term) symptoms (such as eye, nose, throat, and lung irritation) from short-term exposure to smoke may occur.	Risks reduced by limiting strenuous physical activities when air quality is especially poor; and action such as closing tent flaps, windows, and doors. Other control measures include locating burn pits downwind of prevailing winds, increased distance from troop populations, and improved waste segregation and management techniques.	Low: Little or no health impacts at the population level have been identified by DOD as of the date of publication of this summary.

[1] This Summary Table provides a qualitative estimate of population-based short- and long-term health risks associated with the general ambient and occupational environment conditions at Tallil AB and vicinity. It does not represent a unique individual exposure profile. Actual individual exposures and health effects depend on many variables. For example, while a chemical may be present in the environment, if a person does not inhale, ingest, or contact a specific dose of the chemical for adequate duration and frequency, then there may be no health risk. Alternatively, a person at a specific location may experience a unique exposure which could result in a significant individual exposure. Any such person seeking medical care should have their specific exposure documented in an SF600.

[2] This assessment is based on specific environmental sampling data and reports obtained from March 2003 through October 2011. Sampling

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]

locations are assumed to be representative of exposure points for the camp population but may not reflect all the fluctuations in environmental quality or capture unique exposure incidents.

[3] This Summary Table is organized by major categories of identified sources of health risk. It only lists those sub-categories specifically identified and addressed at Tallil AB and vicinity. The health risks are presented as Low, Moderate, High or Extremely High for both short- and long-term health effects. The health risk level is based on an assessment of both the potential severity of the health effects that could be caused and probability of the exposure that would produce such health effects. Details can be obtained from the Army Public Health Center (Provisional) [APHC (Prov)]. Where applicable, "None Identified" is used when though an exposure was identified, no health risk of either a specific short- or long-term health effects were determined. More detailed descriptions of OEH exposures that were evaluated but determined to pose no health risk are discussed in the following sections of this report.

[4] Health risks in this Summary Table are based on quantitative surveillance thresholds (e.g., endemic disease rates; host/vector/pathogen surveillance) or screening levels, e.g., Military Exposure Guidelines (MEGs) for chemicals. Some previous assessment reports may provide slightly inconsistent health risk estimates because quantitative criteria such as MEGs may have changed since the samples were originally evaluated and/or because this assessment makes use of all historic site data while previous reports may have only been based on a select few samples.

1 Discussion of Health Risks at Tallil AB and vicinity, Iraq by Source

The following sections provide additional information about the OEH conditions summarized above. All risk assessments were performed using the methodology described in the U. S. Army Public Health Command Technical Guide 230, *Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel* (Reference 5). All OEH risk estimates represent residual risk after accounting for preventive controls in place. Occupational exposures and exposures to endemic diseases are greatly reduced by preventive measures. For environmental exposures related to airborne dust, there are limited preventive measures available, and available measures have little efficacy in reducing exposure to ambient conditions.

2 Air

2.1 Site-Specific Sources Identified

Personnel deployed to Tallil AB and vicinity were exposed to various airborne contaminants as identified by monitoring and sampling efforts between March 2003 and April 2011. Sources of airborne contaminants at the base camp included diesel vehicle and generator exhaust, dust from unpaved roads and surfaces, operation of one cement plant, aircraft exhaust, incinerators, and burn pits. In addition, dust storms, periods of high winds, and vehicle traffic passing through moon dust (very fine silts with the consistency of talcum powder) contributed to particulate matter (PM) exposures above health-based MEGs at Tallil AB.

2.2 Particulate Matter, less than 10 microns (PM_{10})

2.2.1 Sample data/Notes:

Exposure Guidelines:

Short Term (24-hour) PM_{10} (micrograms per cubic meter, ($\mu g/m^3$):

- Negligible MEG = 250
- Marginal MEG = 420
- Critical MEG = 600

Long-term PM_{10} MEG ($\mu g/m^3$):

- Not defined and not available.

A total of 225 valid PM_{10} air samples were collected from 2003-2004, and 2006-2010. The range of 24-hour PM_{10} concentrations was 54 µg/m^3 –2497 µg/m^3 with an average concentration of 392 µg/m^3.

There were no sampling data for 2005 and 2011.

2.2.2 Short-term health risk:

Variable (Low to High): The short-term PM_{10} health risk assessment estimate was low to high based on typical and peak PM_{10} concentrations, and the likelihood of exposure at these hazard severity levels. A low short-term health risk assessment estimate for typical PM_{10} exposure concentrations at Tallil AB and vicinity suggested the expected losses may have little or no impact on accomplishing the mission. A high short-term health risk assessment estimate for peak PM_{10} exposure concentrations suggested a significant degradation of mission capabilities with the inability to accomplish all parts of the mission, or the inability to complete the mission to standard if hazards occur during the mission (Reference 5, Table 3-2).

The hazard severity was marginal for average PM_{10} sample concentrations. The results suggested that the majority of personnel may have experienced notable eye, nose, or throat irritation and some respiratory effects. Some lost duty days may be expected. Pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.

The hazard severity was critical for the highest observed PM_{10} sample concentrations. During peak exposures at the critical hazard severity level, most, if not all, personnel may have experienced very notable eye, nose and throat irritation respiratory effects. Some personnel may not be able to perform assigned duties. Some lost-duty days may be expected. Those with a history of asthma or cardiopulmonary disease may experience more severe symptoms.

2.2.3 Long-term health risk:

Not evaluated because there are no available health guidelines. The Environmental Protection Agency (EPA) has retracted its long-term National Ambient Air Quality Standard (NAAQS) for PM_{10} due to an inability to link chronic health effects with chronic PM_{10} exposure levels.

2.3 Particulate Matter, less than 2.5 microns ($PM_{2.5}$)

2.3.1 Sample data/Notes:

Exposure Guidelines:

Short Term (24-hour) $PM_{2.5}$ (µg/m^3):

- Negligible MEG = 65
- Marginal MEG = 250
- Critical MEG = 500

Long-term (1-year) $PM_{2.5}$ MEGs (µg/m^3):

- Negligible MEG = 15
- Marginal MEG = 65

A total of 141 valid $PM_{2.5}$ samples were collected in 2006-2011. The range of 24-hour $PM_{2.5}$ concentrations was 10 µg/m^3 – 614 µg/m^3 with an average concentration of 105 µg/m^3. There were no sampling data for 2003-2005.

2.3.2 Short-term health risk:

Low: The short-term $PM_{2.5}$ health risk assessment estimate was low to high based on typical and peak $PM_{2.5}$ concentrations, and the likelihood of exposure at these hazard severity levels. A low short-term health risk assessment estimate for typical $PM_{2.5}$ exposure concentrations at Tallil AB and vicinity suggested the expected losses may have little or no impact on accomplishing the mission. A

high short-term health risk assessment estimate for peak $PM_{2.5}$ exposure concentrations suggested a significant degradation of mission capabilities with the inability to accomplish all parts of the mission, or the inability to complete the mission to standard if hazards occur during the mission (Reference 5, Table 3-2).

The hazard severity was negligible for average $PM_{2.5}$ exposures. The results indicated that a few personnel may have experienced notable eye, nose, and throat irritation; most personnel may experience only mild effects. Pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may have been exacerbated. However, the data quantity was insufficient to characterize the potential short-term health risk from $PM_{2.5}$ exposure to U.S. personnel.

The hazard severity was critical for the highest observed $PM_{2.5}$ sample concentrations. During peak exposures at the critical hazard severity level, most, if not all, personnel may have experienced very notable eye, nose and throat irritation respiratory effects. Some personnel may not be able to perform assigned duties. Some lost-duty days may be expected. Those with a history of asthma or cardiopulmonary disease may experience more severe symptoms.

2.3.3 Long-term health risk:

Moderate: The $PM_{2.5}$ long-term marginal MEG of 65 µg/m^3 was exceeded by the average $PM_{2.5}$ concentrations in 2006 (69 µg/m^3), 2009 (134 µg/m^3), and 2010 (134 µg/m^3). With repeated exposures above the MEG, a small percentage of personnel may have increased risk for developing chronic health conditions such as reduced lung function or exacerbated chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, atherosclerosis, or other cardiopulmonary diseases. Personnel with a history of asthma or cardiopulmonary disease were considered to be at particular risk. However, the data quantity was insufficient to characterize the potential long-term health risk from $PM_{2.5}$ exposure to U.S. personnel.

2.4 Airborne Metals from PM_{10}

2.4.1 Sample data/Notes:

A total of 207 valid PM_{10} airborne metal samples were collected at Tallil AB and vicinity from 2003-2004, and 2006-2010. There were no sampling data for 2005 and 2011.

2.4.2 Short-term health risk:

In 2006, vanadium had a maximum concentration (1.69 µg/m^3) that exceeded the 14-day negligible MEG (0.55 µg/m^3). Short-term risk for vanadium was low. Confidence in the risk estimate was medium.

2.4.3 Long-term health risk:

In 2006, aluminum average concentration (7.2 µg/m^3) exceeded its long-term 1-Year negligible MEG (3.4 µg/m^3), cobalt average concentration (0.0077 µg/m^3) exceeded its long-term 1-Year negligible MEG (5.3 E-07 µg/m^3), and vanadium average concentration (0.19 µg/m^3) exceeded its long-term 1-Year negligible MEG (0.069 µg/m^3). Long-term risk for aluminum, cobalt and vanadium was low. Confidence in the risk estimate is medium.

2.5 Volatile Organic Compounds (VOCs)

The likely sources of VOCs on Tallil AB and vicinity were the result of fuel storage and transfers between storage tanks, vehicles and aircraft.

2.5.1 Sample data/Notes:
The health risk assessment was based on average and peak concentrations of 14 valid volatile organic chemical (VOC) air samples collected between January 2004 and June 2008. None of the analyzed VOC pollutants was found at concentrations above short- or long-term MEGs.

2.5.2 Short and long-term health risks:
None identified based on available sampling data**.**

3 Soil

3.1 Site-Specific Sources Identified

3.1.1 Sample data/Notes:
Analytical data for 42 soil samples collected at Tallil AB and vicinity between April 2003 and October 2011 were available and were assessed for metals, inorganic and organic chemicals, pesticides and herbicides. For the health risk assessment, personnel were assumed to remain at this location for approximately 1 year. No health hazards were identified from surface soil samples collected.

3.1.2 Short-term health risk:
Currently, sampling data for soil are not evaluated for short-term (acute) health risks.

3.1.3 Long-term health risk:
No parameters exceeded 1-year Negligible MEGs.

4 Water

In order to assess the risk to U.S. personnel from exposure to water in theater, the Army Public Health Center (Provisional) (APHC (Prov)) identified the most probable exposure pathways based on available information. The water exposures considered were the ingestion of water used for drinking and the use of water for non-drinking purposes (such as personal hygiene, or showering).

4.1 Drinking Water

4.1.1 Site-Specific Sources Identified
The primary source of drinking water at Tallil AB and vicinity was bottled water and Reverse Osmosis Water Purification Unit (ROWPU)-treated water. Routine field tests conducted by Preventive Medicine and Veterinary personnel and contractors include bacteriological and physical inspection.

4.1.2 Sample data/Notes
Ten drinking water samples were assessed to determine the short-term and long-term health risks. Drinking water samples used in this assessment include one bottled water sample received in 2009, and ROWPU-treated water samples received in 2003 (one sample), 2004 (one sample), 2006 (one sample), 2009 (three samples), 2010 (one sample), and 2011 (two samples). All other years have no samples with which to characterize that particular year.

4.1.3 Short-term health risk:
In 2006, boron [0.99 milligrams per liter (mg/L)] exceeded its 14-day 15 liters per day (L/d) Negligible MEG (0.93 mg/L); magnesium (120 mg/L) exceeded its 14-day 15L/d Negligible MEG (30 mg/L); and sulfate (870 mg/L) exceeded its 14-day 15L/d Negligible MEG (250 mg/L) for short-term health risk.

TB MED 577 notes that the health effects for drinking water with a high concentration of magnesium and sulfate are an increased risk of laxative effects and an increased susceptibility to dehydration because of the increased risk of laxative effects (Reference 8).

4.1.4 Long-term health risk:
The environmental health risk assessment identified chloride, chromium, magnesium, and sulfate as potential long-term health risks. However, long-term MEGs are not available for chloride, chromium, magnesium, and sulfate therefore long-term health risk associated with these chemicals could not be evaluated.

4.2 Water: Used for Other Purposes (Personal Hygiene, Showering, etc.)

4.2.1 Site-Specific Sources Identified

U.S. personnel used the ROWPU-treated water supply and raw well water at Tallil AB and vicinity for non-drinking purposes (i.e., personal hygiene, and showering, etc.).

4.2.2 Sample data/Notes
Forty-five non-drinking water samples were assessed to determine the short and long-term health risk. Water samples representing non-drinking water were collected in 2003 (four samples), 2004 (four samples), 2005 (four samples), 2008 (three samples), 2009 (18 samples), 2010 (11 samples), and 2011 (one sample).

4.2.3 Short-term health risk:
None identified based on available sampling data**.** No parameters exceeded 2.5 times the 14-day, 5 L/d Negligible MEGs.

4.2.4 Long-term health risk:
The environmental health risk assessment identified chloride, chromium, magnesium, nickel, and sulfate as potential long-term health risk. Long-term MEGs are not available for chloride, chromium, magnesium, nickel, sulfate, and trichloroacetic acid, therefore long-term health risk associated with these chemicals could not be evaluated. Confidence in risk estimate is low.

5 Military Unique

5.1 Chemical Biological, Radiological Nuclear (CBRN) Weapons:

No specific hazard sources were documented in Defense Occupational and Environmental Health Readiness System (DOEHRS) or the Military Exposure Surveillance Library (MESL) from March 2003 through October 2011 timeframe (References 1 and 9).

5.2 Depleted Uranium (DU):

A preliminary environmental assessment noted that U.S. military equipment and foreign material and weapon systems found at Tallil AB and vicinity could contain DU (Reference 10). Such items include spent munitions and air-to-air missile warhead aircraft counterweights. Workers handling DU munitions were exposed to minimal levels of radiation and exposure was far below permissible exposure limits. Evidence of spent DU munitions or DU fragments was not found in the soil or dust. Depleted uranium was not considered a hazard at Tallil AB and vicinity.

5.3 Ionizing Radiation:

Medical radiography was utilized in the Expeditionary Medical Squadron Clinic. The radiology technician was the only individual enrolled in the thermoluminescent dosimetry (TLD) program, with

no exposures recorded. Radioactive materials were used in CBRN detection equipment, aircraft ice detection systems, self-luminous dials and gauges, and other generally licensed devices. All radioactive material testing documented in the MESL indicated no detectable radiation or effective radiation doses well below the dose limits (Reference 11).

5.4 Non-Ionizing Radiation:

Lasers:
Aircraft (including unmanned aerial systems) were equipped with lasers (Reference 12). Specific health hazards associated with each laser were documented in the DOEHRS-IH. Administrative procedures were in place to reduce incidents and awareness is extended to promote safety.

Radio Frequency Radiating (RFR) Sources:
Many RFR sources were operated/maintained at the Tallil AB and vicinity, such as radars, vehicular radios, back pack radios, ground emplaced radios, avionics radios, wireless LAN, Satellite Communications Systems, Counter Remote Control Improvised Explosive Device Electronic Warfare Systems, and Cellular and Mobile Phones (Reference 13). RFR system operators and maintenance personnel were the only individuals potentially at risk from exposure to RFR that exceeded the standards. This risk was minimal if safety procedures documented in the system technical manuals were observed. Aircraft and ground-based emitters had administrative processes in place to reduce the potential for exposures and ensure personnel are not within the uncontrolled environment hazard distance. The safety controls for other sources were typically addressed in the technical manuals specific to the particular system. Operator and maintenance personnel should have been aware of safety precautions associated with their RFR sources. Operators of these systems were aware to notify Bioenvironmental Engineering for any potential exposure to RF radiation for investigation and documentation. Observance of the safety precautions precluded personnel from exposure to RFR that exceeds the Department of Defense standards and the standards for the individual services.

Other Non-Ionizing Radiation Sources:
Personnel performing minor arc welding and oxy-acetylene cutting encounter ultraviolet radiation but personal protective equipment was used to minimize the hazard severity and probability (Reference 14).

6 Endemic Diseases[1]

This document lists the endemic diseases reported in the region, its specific health risks and severity and general health information about the diseases. In addition, site-specific information from the MESL database was used. CENTCOM Modification (MOD) 12 (Reference15) lists deployment requirements, to include immunizations and chemoprophylaxis, in effect during the timeframe of this POEMS.

6.1 Foodborne and Waterborne Diseases

Food borne and waterborne diseases in the area are transmitted through the consumption of local food and water. Local unapproved food and water sources (including ice) are heavily contaminated with pathogenic bacteria, parasites, and viruses to which most U.S. Service Members have little or no natural immunity. Effective host nation disease surveillance does not exist within the country. Only a

small fraction of diseases are identified or reported in host nation personnel. Diarrheal diseases are expected to temporarily incapacitate a very high percentage of U.S. personnel within days if local food, water, or ice is consumed. Hepatitis A and typhoid fever infections typically cause prolonged illness in a smaller percentage of unvaccinated personnel. Vaccinations are required for DOD personnel and contractors. In addition, although not specifically assessed in this document, significant outbreaks of viral gastroenteritis (e.g., norovirus) and food poisoning (e.g., Bacillus cereus, Clostridium perfringens, Staphylococcus) may occur. Key disease risks are summarized below:

Mitigation strategies were in place and included consuming food and water from approved sources, vaccinations (when available), frequent hand washing and general sanitation practices.

6.1.1 Diarrheal diseases (bacteriological)

High, mitigated to Low: Unmitigated health risk to U.S. personnel was high year round. Diarrheal diseases (bacteriological) could be expected to temporarily incapacitate a very high percentage of personnel (potentially over 50% per month) within days if local food, water, or ice was consumed. Field conditions (including lack of hand washing and primitive sanitation) may facilitate person-to-person spread and epidemics. Typically, these result in mild disease treated in outpatient setting; recovery and return to duty in less than 72 hours with appropriate therapy. A small proportion of infections may require greater than 72 hours limited duty, or hospitalization.

6.1.2 Hepatitis A

High, mitigated to Low: Unmitigated health risk to U.S. personnel was high year round. U.S. Personnel did not drink untreated water, and vaccination for Hepatitis A is required for deployment into the CENTCOM Area of Responsibility (AOR). Hepatitis A typically occurs after consumption of fecally contaminated food or water or through direct fecal-oral transmission under conditions of poor hygiene and sanitation. Field conditions (including primitive sanitation, lack of hand washing) may facilitate outbreaks driven by person-to-person spread. A typical case involves 1 to 3 weeks of debilitating symptoms, sometimes initially requiring inpatient care; recovery and return to duty may require a month or more.

6.1.3 Typhoid/paratyphoid Fever

High, mitigated to Low: Unmitigated health risk to U.S. personnel was high year round. Risk was typically highest following spring floods. Typhoid and paratyphoid fever are acquired through the consumption of fecally contaminated food or water. The two diseases are clinically similar, and in areas where they are endemic, typhoid typically accounts for 90% of cases. Asymptomatic carriers are common with typhoid and contribute to sustained transmission. In countries with a mixture of primitive and modern sanitation and hygiene, outbreaks of typhoid fever can occur and may involve all age groups. A small number of cases (less than 1% per month attack rate) could occur among unvaccinated personnel consuming local food, water, or ice. With appropriate treatment, typhoid and paratyphoid fever are debilitating febrile illnesses typically requiring 1 to 7 days of supportive care, followed by return to duty.

6.1.4 Diarrhea - protozoal

Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. Risk was typically highest following spring floods. In general, *Cryptosporidium* spp., *Entamoeba histolytica*, and *Giardia lamblia* were the most common protozoal causes of diarrhea wherever sanitary conditions were significantly below U.S. standards. A small number of cases (less than 1% per month attack rate) could occur among personnel consuming local food, water, or ice. Outbreaks affecting a higher percentage of personnel were possible with *Cryptosporidium*. Symptomatic cases may vary in severity; typically mild disease demonstrating recovery and return to duty in less than 72

hours with appropriate therapy; severe cases may require 1 to 7 days of supportive care, followed by return to duty.

6.1.5 Brucellosis

Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. Brucellosis is a common disease in cattle, sheep, goats, swine, and some wildlife species in most developing countries. Humans contract brucellosis through consumption of contaminated dairy products (or foods made with such products) or by occupational exposures to infected animals. The health risk from direct animal contact was likely to be highest in rural areas where livestock were present. The health risk from contaminated dairy products exists countrywide, including urban areas. Rare cases (less than 0.1% per month attack rate) could occur among personnel consuming local dairy products or having direct contact with livestock. With appropriate treatment, brucellosis is a febrile illness of variable severity, potentially requiring inpatient care; convalescence is usually over 7 days even with appropriate treatment.

6.1.6 Diarrhea - cholera

Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. Development of symptomatic cholera requires exposure to large inoculums and typically is associated with ingestion of heavily contaminated food or water. Person-to-person spread of cholera occurs very infrequently, if at all. The majority of infections (75% or more, depending on biotype) among healthy adults are very mild or asymptomatic. Only a small percentage of infections are severe. Because cholera frequently causes serious public health impact, cholera cases are more likely to be reported under the International Health Regulations than other types of diarrhea. Rare cases (less than 0.1% per month attack rate) could occur among personnel consuming local food, water, or ice. Most symptomatic cases are mild, with recovery and return to duty in less than 72 hours on appropriate outpatient treatment; severe cases may require 1-7 days of supportive or inpatient care, followed by return to duty.

6.1.7 Hepatitis E

Low: Unmitigated health risk to U.S. personnel was low year round. Risk was typically highest following spring floods. Hepatitis E occurs in four major genotypes. Genotypes 1 and 2, found primarily in Africa and Asia, cause large numbers of sporadic cases, as well as large outbreaks. Fecal contamination of drinking water is the most common source of exposure for these genotypes. Large outbreaks are usually associated with particularly severe breakdowns in baseline sanitation, as often occurs during heavy rainfall which increases mixing of sewage and drinking water sources. Secondary household cases from person-to-person transmission are uncommon. Unlike hepatitis A, where local populations living in poor sanitary conditions were usually highly immune from childhood exposures, immunity levels for hepatitis E were often much lower, even in areas of extremely poor sanitation. Typically, outbreaks of hepatitis E occur primarily among adults. Although data are insufficient to assess potential disease rates, we cannot rule out rates approaching 1% per month among personnel consuming local food, water, or ice. Rates may exceed 1% per month for personnel heavily exposed during outbreaks in the local population. Typical case involves 1 to 3 weeks of debilitating symptoms, sometimes initially requiring inpatient care; recovery and return to duty may require a month or more.

6.1.8 Short-term health risk:

Low/None: The overall short-term unmitigated health risk associated with other food borne and waterborne diseases at Tallil AB and vicinity was considered high (bacterial diarrhea, hepatitis A, typhoid fever), moderate (diarrhea-protozoal, diarrhea-cholera, brucellosis), and low (Hepatitis E) if local food or water was consumed. Confidence in the risk estimate was medium.

6.1.9 Long-term health risk:
None identified based on available data. Confidence in the risk estimate was medium.

6.2 Arthropod Vector-Borne Diseases

During the warmer months, the climate and ecological habitat support populations of arthropod vectors, including mosquitoes, ticks, mites, and sandflies. Significant disease transmission is sustained countrywide, including urban areas. Mitigation strategies were in place and included proper wear of treated uniforms, application of repellent to exposed skin, and use of bed nets and chemoprophylaxis (when applicable). Additional methods included the use of pesticides, reduction of pest/breeding habitats, and engineering controls.

6.2.1 Malaria
None: Indigenous transmission of malaria in Iraq was eliminated as of 2008 reducing risk among personnel exposed to mosquito bites to None.

6.2.2 Leishmaniasis-cutaneous
High, mitigated to Moderate: Unmitigated health risk to U.S. personnel was high with seasonal transmission (April-November). Leishmaniasis-cutaneous (CL) (acute form) is transmitted by sandflies. The incubation period for CL is weeks to months. According to a 2003 executive summary, approximately, one-tenth of Soldiers deployed to Operation Iraqi Freedom were exposed to CL in the vicinity of Tallil AB (References 11 and 16). Large lesions and lesions on the face, ear, hand, foot or joint of Soldiers require evacuation for further evaluation and treatment. Small lesions, even if left untreated, will heal spontaneously within weeks or months.

6.2.3 Sandfly fever
Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate with seasonal transmission (May-June and September-October). The disease is transmitted by sandflies, which typically bite at night and breed in dark places rich in organic matter, particularly in rodent or other animal burrows. Rare cases are possible. Although data are insufficient to assess potential disease rates, 1% to 10% of personnel could be affected per month under worst-case conditions with no mitigation measures in place. Incidents can result in debilitating febrile illness typically requiring 1 to 7 days of supportive care followed by return to duty.

6.2.4 Leishmaniasis – visceral
Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate with seasonal transmission (April-November). Leishmaniasis-visceral is transmitted by sandflies. Rare cases are possible among personnel exposed to sandfly bites in areas with infected humans, dogs, or other reservoir animals. Asymptomatic chronic infections may occur and may become symptomatic years later. When symptomatic, causes a severe febrile illness, which typically requires hospitalization with convalescence over 7 days. According to a 2003 executive summary, there have been no confirmed cases of visceral leishmaniasis among troops deployed to Operation Iraqi Freedom (References 11 and 16).

6.2.5 Crimean-Congo hemorrhagic fever
Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. Crimean-Congo hemorrhagic fever (CCHF) infections can occur as sporadic cases or clusters of cases, and are associated with tick bites or occupational contact with blood or secretions from infected animals. Outbreaks of CCHF occur infrequently. It is a very severe illness typically requiring intensive care with fatality rates from 5% to 50%.

6.2.6 Sindbis (and Sindbis-like viruses)
Low: Unmitigated health risk to U.S. personnel was low with seasonal transmission (April-November). Sindbis and sindbis-like viruses are maintained in a bird-mosquito cycle in rural areas and occasionally caused limited outbreaks among humans. The viruses are transmitted by a variety of *Culex* mosquito species found primarily in rural areas. A variety of bird species may serve as reservoir or amplifying hosts. Extremely rare cases (less than 0.01% per month attack rate) could have occurred seasonally (April - November). Debilitating febrile illness often accompanied by rash, typically requires 1 to 7 days of supportive care; significant arthralgias may persist for several weeks or more in some cases.

6.2.7 Rickettsioses, tickborne (spotted fever group)
Low: Unmitigated health risk to U.S. personnel was low with seasonal transmission (April-November). Rare cases (less than 0.1% per month) of rickettsioses disease are possible among personnel exposed to tick bites. Rickettsioses are transmitted by multiple species of hard ticks, including *Rhipicephalus* spp., which are associated with dogs. Other species of ticks, including *Ixodes* are also capable of transmitting rickettsial pathogens in this group. In addition to dogs, various rodents and other animals also may serve as reservoirs. Ticks are most prevalent from April through November. Incidents can result in debilitating febrile illness, which may require 1 to 7 days of supportive care followed by return to duty.

6.2.8 Typhus-murine (fleaborne)
Low: Unmitigated health risk to U.S. personnel was low year round. Typhus-murine is assessed as present, but at unknown levels. Rare cases are possible among personnel exposed to rodents (particularly rats) and fleabites. Incidents may result in debilitating febrile illness typically requiring 1 to 7 days of supportive care followed by return to duty.

6.2.9 West Nile fever
Low: Unmitigated health risk to U.S. personnel was low with seasonal transmission (April-November). West Nile fever was present and maintained by the bird population and mosquitoes that help to transfer the diseases from birds to humans. The majority of infections in young, healthy adults are asymptomatic although it can result in fever, headache, tiredness, and body aches, occasionally with a skin rash (on the trunk of the body) and swollen lymph glands. West Nile fever is a febrile illness typically requiring 1-7 days of inpatient care followed by return to duty; convalescence may be prolonged.

6.2.10 Short-term health risk:
Low: The overall short-term unmitigated health risk associated with arthropod vector-borne diseases at Tallil AB and vicinity was considered moderate (for sandfly fever, leishmaniasis (cutaneous and visceral), and Crimean-Congo hemorrhagic fever) and low (for rickettsioses, typhus-murine (fleaborne) West Nile fever, and sindbis). Preventive measures such as IPM practices, proper wear of treated uniforms and application of repellent to exposed skin reduced the health risk to low to none for arthropod vector-vector borne diseases. Confidence in the risk estimate was medium.

6.2.11 Long-term health risk:
Low: The unmitigated risk is moderate for leishmaniasis-visceral (chronic). Risk was reduced to low by proper wear of the uniform and application of repellent to exposed skin. Confidence in the risk estimate is high.

6.3 Water Contact Diseases

Tactical operations or recreational activities that involve extensive contact with surface water such as lakes, streams, rivers, or flooded fields may result in significant exposure to leptospirosis and schistosomiasis. Arid portions of Iraq without permanent or persistent bodies of surface water do not support transmission of leptospirosis or schistosomiasis. Risk was restricted primarily to areas along rivers and lakes. These diseases can debilitate personnel for up to a week or more. Leptospirosis risk typically increases during flooding. In addition, although not specifically assessed in this document, bodies of surface water are likely to be contaminated with human and animal waste. Activities such as wading or swimming may result in exposure to enteric diseases including diarrhea and hepatitis via incidental ingestion of water. Prolonged water contact also may lead to the development of a variety of potentially debilitating skin conditions including bacterial or fungal dermatitis. Mitigation strategies were in place and included avoiding water contact and recreational water activities, proper wear of uniform (especially footwear), and protective coverings for cuts/abraded skin.

6.3.1 Leptospirosis

Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate with seasonal transmission (April-November). Human infections occur through exposure to water or soil contaminated by infected animals and is associated with wading, and swimming in contaminated, untreated open water. The occurrence of flooding after heavy rainfall facilitates the spread of the organism because as water saturates the environment *Leptospira* present in the soil passes directly into surface waters. *Leptospira* can enter the body through cut or abraded skin, mucous membranes, and conjunctivae. Infection may also occur from ingestion of contaminated water. The acute, generalized illness associated with infection may mimic other tropical diseases (for example, dengue fever, malaria, and typhus), and common symptoms include fever, chills, myalgia, nausea, diarrhea, cough, and conjunctival suffusion. Manifestations of severe disease can include jaundice, renal failure, hemorrhage, pneumonitis, and hemodynamic collapse. Recreational activities involving extensive water contact may result in personnel being temporarily debilitated with leptospirosis.

6.3.2 Schistosomiasis

Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate with seasonal transmission (April-November). Humans are the principal reservoir for schistosomes; humans shed schistosome eggs in urine or feces. Animals such as cattle and water buffalo may also be significant reservoirs. Rare cases (less than 0.1% per month attack rate) may occur among personnel wading or swimming in lakes, streams, or irrigated fields which were frequently contaminated with human and animal waste containing schistosome eggs. In groups with prolonged exposure to heavily contaminated foci, attack rates may exceed 10%. Exceptionally heavy concentrations of schistosomes may occur in discrete foci, which were difficult to distinguish from less contaminated areas. In non-immune personnel exposed to such foci, rates of acute schistosomiasis may be over 50%. Mild infections are generally asymptomatic. In very heavy acute infections, a febrile illness (acute schistosomiasis) may occur, especially with *Schistosoma japonicum* and *S. mansoni*, requiring hospitalization and convalescence over 7 days.

6.3.3 Short-term health risk:

Low: The overall short-term unmitigated health risk associated with water contact diseases at Tallil AB and vicinity was considered moderate (for leptospirosis and schistosomiasis). Preventive measures such as avoiding water contact and recreational water activities; and protective coverings for cuts/abraded skin reduced the health risk to low to none. Confidence in the risk estimate was medium.

6.3.4 Long-term health risk:
None identified based on available data. Confidence in the risk estimate was medium.

6.4 Respiratory Diseases

Although not specifically assessed in this document, deployed U.S. forces may be exposed to a wide variety of common respiratory infections in the local population. These include influenza, pertussis, viral upper respiratory infections, viral and bacterial pneumonia, and others. The U.S. military populations living in close-quarter conditions are at risk for substantial person-to-person spread of respiratory pathogens. Influenza is of particular concern because of its ability to debilitate large numbers of unvaccinated personnel for several days. Mitigation strategies were in place and included routine medical screenings, vaccination, enforcing minimum space allocation in housing units, implementing head-to-toe sleeping in crowded housing units, implementation of proper personal protective equipment (PPE) when necessary for healthcare providers and detention facility personnel.

6.4.1 Tuberculosis (TB)
Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. Tuberculosis (TB) is usually transmitted through close and prolonged exposure to an active case of pulmonary or laryngeal TB, but can also occur with incidental contact. Individuals with prolonged indoor exposure to the local population are at increased risk for latent TB infection. Additional mitigation included active case isolation in negative pressure rooms, where available.

6.4.2 Meningococcal meningitis
Low: Unmitigated health risk to U.S. personnel was low year round. Meningococcal meningitis is transmitted from person to person through droplets of respiratory or throat secretions. Risk is comparable to the U.S. among unvaccinated personnel who have close contact with the local population. Close and prolonged contact facilitates the spread of this disease. Meningococcal meningitis is a potentially very severe disease typically requiring intensive care; fatalities may occur in 5-15% of cases.

6.4.3 Short-term health risk:
Low: The overall short-term unmitigated health risk associated with respiratory diseases at Tallil AB and vicinity was considered moderate (for tuberculosis) to low (for meningococcal meningitis). Preventive measures such as vaccination; routine medical screenings; and active case isolation in negative pressure rooms reduced the health risk to low to none. Confidence in the risk estimate was medium.

6.4.4 Long-term health risk:
None identified based on available data. TB was evaluated as part of the post deployment health assessment (PDHA). A TB skin test was required post-deployment if potentially exposed and was based upon individual service policies.

6.5 Animal-Contact Diseases

6.5.1 Rabies
Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. Occurrence in local animals was well above U.S. levels due to the lack of organized control programs. Dogs were the primary reservoir of rabies in Iraq, and a frequent source of human exposure. In June 2008, the New Jersey Health department in The United States reported a confirmed case of rabies in a mixed-breed dog recently imported from Iraq (Reference 17). Rabies is transmitted by exposure to the virus-laden saliva of an infected animal, typically through bites, but could occur from scratches contaminated with the saliva. No cases of rabies acquired in Iraq have been identified in U.S. Service

Members to date. The vast majority (>99%) of persons who develop rabies disease will do so within a year after a risk exposure, there have been rare reports of individuals presenting with rabies disease up to six years or more after their last known risk exposure. Mitigation strategies included command emphasis of CENTCOM GO 1B, reduction of animal habitats, active pest management programs, and timely treatment of feral animal scratches/bites.

6.5.2 Q-Fever

Moderate, mitigated to Low: Potential health risk to U.S. personnel was moderate year round. Rare cases were possible among personnel exposed to aerosols from infected animals, with clusters of cases possible in some situations. Significant outbreaks (affecting 1-50%) could occur in personnel with heavy exposure to barnyards or other areas where animals are kept. Unpasteurized milk may also transmit infection. The primary route of exposure is respiratory, with an infectious dose as low as a single organism. Q-Fever is a debilitating febrile illness, sometimes presenting as pneumonia, typically requiring 1 to 7 days of inpatient care followed by return to duty. Mitigation strategies include consuming approved food sources, avoidance of animals and farms, dust abatement when working in these areas (wet mop, water sprayed on high volume traffic areas, etc.), and proper PPE for personnel working with animals, and immunization.

6.5.3 Anthrax

Low: Unmitigated health risk to U.S. personnel was low year round. Cutaneous and gastrointestinal anthrax are the most common forms of naturally occurring infection; cutaneous anthrax is transmitted by direct contact with infected animals or carcasses, including hides. Eating undercooked infected meat can result in contracting gastrointestinal anthrax. Pulmonary anthrax is contracted through inhalation of spores and is extremely rare. Cutaneous anthrax typically requires 1 to 7 days of supportive care with subsequent return to duty; gastrointestinal anthrax typically requires hospitalization, and has a high fatality rate if untreated. Mitigation strategies include consuming approved food sources, avoidance of animals and farms, dust abatement when working in these areas (wet mop, water sprayed on high volume traffic areas, etc.), and proper PPE for personnel working with animals, and immunization.

6.5.4 H5N1 avian influenza

Low: Unmitigated health risk to U.S. personnel was low year round. Extremely rare cases could occur in U.S. personnel who have close contact with birds or poultry infected with H5N1. H5N1 is a very severe illness. The fatality rate is higher than 50% in symptomatic cases. Mitigation strategies include avoidance with birds/poultry and proper cooking temperatures for poultry products.

6.5.5 Short-term health risk:

Low to None: The overall short-term unmitigated health risk associated with animal contact diseases at Tallil AB and vicinity was considered moderate (for rabies, Q-fever) to Low (for anthrax, H5N1 avian influenza). Preventive measures such as consuming approved food sources; immunization; and avoidance of animals and farms reduced the health risk to low to none. Confidence in risk estimate was medium.

6.5.6 Long-term health risk:

Low: The long-term risk for rabies is low because the incubation period for rabies can be several years in rare cases.

7 Venomous Animal/Insect

All information was taken directly from the Armed Forces Pest Management Board (Reference 18) and the Clinical Toxinology Resources web site from the University of Adelaide, Australia (Reference

19). The species listed below have home ranges that overlap the location of Tallil AB and vicinity, and may present a health risk if they are encountered by personnel. See Section 10.3 for more information about pesticides and pest control measures.

7.1 Spiders

- *Latrodectus pallidus*: Clinical effects uncertain, but related to medically important species, therefore major envenoming cannot be excluded.

7.2 Scorpions

- *Androctonus crassicauda (black scorpion):* Severe envenoming possible and potentially lethal, however most stings cause only severe local pain.
- *Buthacus leptochelys*, *Buthacus macrocentrus*, *Compsobuthus jakesi*, *Compsobuthus matthiesseni*, *Compsobuthus werneri Odontobuthus doriae*, *Orthochirus iraqus*, and *Orthochirus scrobiculosus*: Clinical effects unknown; there are a number of dangerous Buthid scorpions, but also others known to cause minimal effects only. Without clinical data it is unclear where this species fits within that spectrum.
- *Euscorpius italicus* and *Scorpio maurus*: Mild envenoming only, not likely to prove lethal.
- *Hemiscorpius lepturus*: Severe envenoming possible, potentially lethal.
- *Hottentotta saulcyi*, *Hottentotta scaber*, and *Hottentotta schach*: Moderate envenoming possible but unlikely to prove lethal.

7.3 Snakes

- *Cerastes cerastes* and *Cerastes gasperettii*: Potentially lethal envenoming, though unlikely.
- *Echis sochureki*: *M*oderate to severe, potentially lethal envenoming.
- *Hemorrhois ravergieri*, *Malpolon monspessulanus*, *Psammophis schokari*, *Pseudocyclophis persicus, Telescopus fallax* and *Telescopus tessellatus*: Clinical effects unknown, but unlikely to cause significant envenoming.
- *Macrovipera lebetina* subspecies e*uphratica* and subspecies *obtusa,and Vipera albicornuta*: Severe envenoming possible, potentially lethal.
- *Platyceps rhodorachis* and *Psammophis lineolatus*: Mild envenoming only, not likely to prove lethal.
- *Walterinnesia aegyptia*: Clinical effects unknown, but potentially lethal envenoming, though unlikely, cannot be excluded.

7.4 Short-term health risk:
Low: If encountered, effects of venom vary with species from mild localized swelling (e.g., *S. maurus*) to potentially lethal effects (e.g., *V. albicornuta*). Confidence in the health risk estimate is low (Reference 5, Table 3-6).

7.5 Long-term health risk:
None identified.

8 Heat/Cold Stress

Average temperatures in Iraq range from higher than 118 degrees Fahrenheit (°F) in July and August to below freezing in January based on historical climatological data from the U.S. Air Force Combat Climatology Center, 14th Weather Squadron (Reference 20). Most of the rainfall occurs from December through April and averages between 3.9 - 7.1 inches annually. The mountainous region of northern Iraq receives appreciably more precipitation than the central or southern desert region. Roughly, 90% of the annual rainfall occurs between November and April, most of it in the winter

months from December through March. The remaining six months, particularly the hottest ones of June, July, and August, are dry.

The summer months are marked by two kinds of wind phenomena. The southern and southeasterly *sharqi*, a dry, dusty wind with occasional gusts of 50 miles per hour, occurs from April to early June and again from late September through November. It may last for a day at the beginning and end of the season but for several days at other times. This wind is often accompanied by violent dust storms that may rise to heights of several thousand meters and close airports for brief periods. From mid-June to mid-September the prevailing wind, called the shamal, is from the north and northwest. It is a steady wind, absent only occasionally during this period. The very dry air brought by this shamal permits intensive sun heating of the land surface, but the breeze has some cooling effect. Heat stress/injuries and cold stress/injuries are largely dependent on operational and individual factors instead of environmental factors alone (Reference 21).

8.1 Heat

The highest monthly mean daily temperature at Tallil AB and vicinity is 110 °F.

8.1.1 Short-term health risk:

Low: The short-term health risk of heat injury was high in unacclimated personnel. Preventive measures such as work-rest cycles; and proper hydration reduced the health risk to low.

8.1.2 Long-term health risk:

Low: The long-term health risk may be greater to certain susceptible persons–those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions. Long-term health implications from heat injuries were rare but could occur–especially from more serious heat injuries such as heat stroke. It was possible that high heat in conjunction with various chemical exposures could increase long-term health risks, though specific scientific evidence was not conclusive. Confidence in these risk estimates was medium.

8.2 Cold

The lowest monthly mean daily temperature for Tallil AB and vicinity is 45°F.

Short- and Long-term health risks: The risk of cold injury was low. Confidence in this risk estimate was medium.

9 Noise

9.1 Continuous:

The flight line area was classified as a hazardous noise area when aircraft and aircraft generating equipment were operating. Personnel working around the aircraft engines and the auxiliary power unit wear double hearing protection. Other sources of continuous noise included workplace equipment, generators, and certain motor vehicles and forklifts. Most hazardous noise equipment was properly marked with the appropriate warning. Workplace surveillance reports identified the proper hearing protection required for the hazardous noise equipment and noted the hearing protection devices available offer adequate protection. Workplace surveillance data were available in the MESL.

Short- and Long-term health risks: **Low**. The unmitigated health risk was high for individuals working near major noise sources without proper hearing protection. Risk was reduced to low through use of proper hearing protection. Confidence in risk estimate was medium.

9.2 Impulse:

The disposal of explosive ordnance can result in impulse levels of noise as high as 162 decibels adjusted. Personnel were adequately protected based on the current hearing protection and the infrequent exposure to the impulse noise.

Short- and Long-term health risks: **Low**. The unmitigated health risk was moderate for individuals working near major noise sources without proper hearing protection. Risk was reduced to low through use of proper hearing protection. Confidence in risk estimate was medium.

10 Other Unique Occupational Hazards

10.1 Potential environmental contamination sources

DoD personnel are exposed to various chemical, physical, ergonomic, and biological hazards in the course of performing their mission. These types of hazards depend on the mission of the unit and the operations and tasks which the personnel are required to perform to complete their mission. The health risk associated with these hazards depends on a number of elements including what materials are used, how long the exposures last, what is done to the material, the environment where the task or operation is performed, and what controls are used. The hazards can include exposures to heavy metal particulates (e.g., lead, cadmium, manganese, chromium, and iron oxide), solvents, fuels, oils, and gases (e.g., carbon monoxide, carbon dioxide, oxides of nitrogen, and oxides of sulfur). Most of these exposures occur when performing maintenance task such as painting, grinding, welding, engine repair, or movement through contaminated areas. Exposures to these occupational hazards can occur through inhalation (air), skin contact, or ingestion; however, exposures through air are generally associated with the highest health risk.

10.2 Fuel/Petroleum Products/Industrial Chemical Spills

There were a number of potential fuel/petroleum/industrial chemical sources at Tallil AB including, a retail gas station, a maintenance garage, aboveground storage tanks, underground storage tanks, pipeline systems, petroleum distribution points. Spills were noted at the petroleum distribution points but no leaks or spills were associated with the other potential sources.

Short- and Long-term health risks: Unknown. Although some spills were observed there were no further data with which to assess risk levels.

10.3 Pesticides/Pest Control

No specific hazards from pesticides/pest control were documented in DOEHRS or MESL data portals from March 2003 through October 2011 (References 1 and 9).

10.4 Waste Sites/Waste Disposal

In 2003, solid wastes at Tallil AB were disposed via burn pits at the location. By 2008, solid wastes at Tallil AB were disposed of in two municipal solid waste (MSW) incinerators and the burn pit. Regulated medical wastes that were generated from the Tallil AB were collected in dedicated medical waste storage areas behind the base clinic and twice daily transported in a marked truck to a medical waste incinerator. The volume of solid wastes or medical wastes generated was estimated at 7.7-10 lbs/person/day.

Short- and Long-term health risks: Unknown. Only sparse qualitative data on waste sites and waste disposal was available. Therefore, there are no data with which to assess risk levels.

10.5 General Sanitation

A memorandum dated 1 January 2010, stated Soldiers complained about bird excrement and feathers in Motorpool 5 (Reference 22). The motorpool represented a significant health hazard to the Soldiers due to excess of excrement and feathers. It was recommended that the excrement be cleaned up by a contractor or hazmat group and not Soldiers due to fungal or bacterial spores being disturbed and inhaled or build a new tent facility to accommodate motorpool operations. No subsequent information was documented in DOEHRS or the MESL data portals.

10.6 Lead- based Paint

Due to the age of buildings within Tallil AB, the buildings were suspected to contain lead based paint, however because the suspected buildings were not populated there was no risk. No specific hazards from lead-based paint were documented in DOEHRS or MESL data portals from March 2003 through October 2011.

10.7 Asbestos

No specific hazard sources were documented in the DOEHRS, or MESL from March 2003 to October 2011 timeframe (References 1 and 9).

10.8 Burn Pits

In 2003, all garbage was disposed via an excavated open burn pit. By 2008, two MSW incinerators were being used in addition to the burn pit for solid waste disposal. The burn pit was located downwind on the eastern edge of the base but at times the plume blew in the direction of the camp. Exposure was generally limited to pit operators and personnel operating in downwind locations. All burn pits in Iraq were shut down by 31 December 2010 and transitioned to incinerators.

While not specific to Tallil AB and vicinity, the consolidated epidemiological and environmental sampling and studies on burn pits that have been conducted as of the date of this publication have been unable to determine whether an association does or does not exist between exposures to emissions from the burn pits and long-term health effects (Reference 23). The Institute of Medicine committee's (Reference 23) review of the literature and the data suggests that service in Iraq or Afghanistan (i.e., a broader consideration of air pollution than exposure only to burn pit emissions) may be associated with long-term health effects, particularly in susceptible (e.g., those who have asthma) or highly exposed subpopulations, such as those who worked at the burn pit. Such health effects would be due mainly to high ambient concentrations of PM from both natural and anthropogenic sources, including military sources. If that broader exposure to air pollution turns out to be relevant, potentially related health effects of concern are respiratory and cardiovascular effects and cancer. Susceptibility to the PM health effects could be exacerbated by other exposures, such as stress, smoking, local climatic conditions, and co-exposures to other chemicals that affect the same biologic or chemical processes. Individually, the chemicals measured at burn pit sites in the study were generally below concentrations of health concern for general populations in the United States. However, the possibility of exposure to mixtures of the chemicals raises the potential for health outcomes associated with cumulative exposure to combinations of the constituents of burn pit emissions and emissions from other sources.

11 References[2]

1. Defense Occupational and Environmental Health Readiness System (referred to as the DOEHRS-EH database) at https://doehrs-ih.csd.disa.mil/Doehrs/. Department of Defense (DoD) Instruction 6490.03, *Deployment Health*, 2006.

2. DoDI 6055.05, Occupational and Environmental Health, 2008.

3. Joint Staff Memorandum (MCM) 0017-12, Procedures for Deployment Health Surveillance, 2012.

4. Environmental Site Survey for Tallil Air Base, Iraq for Deployment of Forces in Support of "Operation Iraqi Freedom" 21 April 2003, Rev. 1.

5. USAPHC TG230, June 2013 Revision, Final Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel TG230.

6. Status report of the Environmental Program for Ali Base. 27 April 2006.

7. Preventive Medicine Base Camp Assessment for COB Adder, Tallil, Iraq, September 2008, 5 October 2008.

8. TB MED 577, Sanitary Control and Surveillance of Field Water Supplies, 1 May 2010.

9. DoD MESL Data Portal: https://mesl.apgea.army.mil/mesl/. Some of the data and reports used may be classified or otherwise have some restricted distribution.

10. Chronological Record of Medical Care. Environmental/Occupational Health Workplace Exposure Data, 407 ECES Power Production, Ali Air Base, Iraq. 1 May-31 Sept 07.

11. Chronological Record of Medical Care. Environmental Occupational Health Workplace Exposure Data, Tallil Air Base, Iraq. 01 Nov 03 to 31 Mar 04.

[2] NOTE. The data are currently assessed using the 2013 TG230 document. The general method involves an initial review of the data which eliminates all chemical substances not detected above 1-yr negligible MEG. Those substances screened out are not considered acute or chronic health hazards so are not assessed further. For remaining substances, acute and chronic health effects are evaluated separately for air and water (soil is only evaluated for long-term risk). This is performed by deriving separate short-term and long-term population exposure level estimates (referred to as population exposure point concentrations (PEPC) that are compared to MEGs derived for similar exposure durations. If less than or equal to negligible MEG the risk is Low. If levels are higher than negligible then there is a chemical-specific toxicity and exposure evaluation by appropriate SMEs, which includes comparison to any available marginal, critical or catastrophic MEGs. For drinking water, 15 L/day MEGs are used for the screening while site specific 5-15 L/day are used for more detailed assessment. For non-drinking water (such as that used for personal hygiene or cooking), the 'consumption rate' is limited to 2 L/day (similar to the EPA) which is derived by multiplying the 5 L/day MEG by a factor of 2.5 to conservatively assess non-drinking uses of water.

12. Department of the Air Force. Subject: Unmanned Aeriel Systems Laser Boresight Facility Safety. 27 May 2008.

13. Department of the Air Force. Subject: Potential over Exposure of the Radiofrequency Radiation (RFR). 14 Nov 2006.

14. Department of the Air Force. Subject: Hazardous Material Locker Assessment. 27 Sept 2006.

15. Modification 12 to United States Central Command Individual Protection and Individual Unit Deployment Policy, 13 December 2013.

16. POPM (Propenency Office of Preventive Medicine) Information Paper. Subject: Leishmaniasis among soldiers deployed to OIF/OEF, 31 December 2003.

17. CDC. 2012. Morbidity and Mortality Weekly Report. Imported Human Rabies in a U.S. Army Soldier. May 4, 2012. 61(17); 302-305.

18. Armed Forces Pest Management Board: http://www.afpmb.org/content/venomous-animals-country-i#Iraq. U.S. Army Garrison - Forest Glen, Silver Spring, MD.

19. Clinical Toxinology Resources: http://www.toxinology.com/. University of Adelaide, Australia.

20. U.S. Air Force Combat Climatology Center. 14th Weather Squadron. https://notus2.afccc.af.mil/SCISPublic/.

21. Goldman R.F. 2001. Introduction to heat-related problems in military operations. *In*: Textbook of Military Medicine: Medical Aspects of Harsh Environments Vol. 1, Pandolf KB, and Burr RE (Eds.), Office of the Surgeon General, Department of the Army, Washington DC.

22. Memorandum for Record. Subject: Bird droppings in the building in Motorpool 5 on COB Adder. 1 January 2010.

23. IOM (Institute of Medicine). 2011. Long-term health consequences of exposure to burn pits in Iraq and Afghanistan. Washington, DC: The National Academies Press.

12 Where Do I Get More Information?

If a provider feels that the Service member's or Veteran's current medical condition may be attributed to specific OEH exposures at this deployment location, he/she can contact the Service-specific organization below. Organizations external to DOD should contact Deputy Assistant Secretary of Defense for Health Readiness Policy and Oversight (HRP&O).
Army Public Health Center (Provisional) Phone: (800) 222-9698. http://phc.amedd.army.mil
Navy and Marine Corps Public Health Center (NMCPHC) (formerly NEHC) Phone: (757) 953-0700. http://www.med.navy.mil/sites/nmcphc/Pages/Home.aspx
U.S. Air Force School of Aerospace Medicine (USAFSAM) (formerly AFIOH) Phone: (888) 232-3764. http://www.wpafb.af.mil/afrl/711hpw/usafsam.asp
DoD, Deputy Assistant Secretary of Defense for Health Readiness Policy and Oversight (HRP&O) Phone: (800) 497-6261. http://fhpr.dhhq.health.mil/home.aspx